

CLAIMS

WHAT IS CLAIMED IS:

1. A compound storage and retrieval system comprising:
 - (a) one or more storage modules comprising a lockable door controlling access to one or more racks, which racks comprise one or more slots, which slots receive one or more trays;
 - (b) a work area, providing operator access to the one or more storage modules; and,
 - (c) a computer system, operably coupled to the storage modules that implement one or more tray transfer operations between the storage module and the work area.
2. The compound storage and retrieval system of claim 1, wherein the work area has a low relative humidity.
3. The compound storage and retrieval system of claim 1, wherein the work area temperature is 1 to 8°C and has a relative humidity of less than 40%.
4. The compound storage and retrieval system of claim 1, further comprising an antechamber comprising: operator access to the work area, a low relative humidity, and a temperature from 4°C to 20°C.
5. The compound storage and retrieval system of claim 1, wherein the computer system transmits one or more commands directing function of a lock, which lock controls operator access to the storage module.
6. The compound storage and retrieval system of claim 5, wherein the lock comprises 100 pounds of magnetic locking force or more, and which lock is controllable by the computer system.
7. The compound storage and retrieval system of claim 1, wherein the computer transmits one or more commands directing actuation of one or more tray location indicators that direct an operator to a tray location of interest.
8. The compound storage and retrieval system of claim 1, wherein the lockable door opens sufficiently to allow removal of the racks.

9. The compound storage and retrieval system of claim 1, wherein the storage modules comprise an internal temperature of -20°C or less.

10. The compound storage and retrieval system of claim 1, wherein the storage modules comprise temperature control at temperature settings ranging from about -20°C to about -55°C.

11. The compound storage and retrieval system of claim 10, wherein the storage modules are temperature controlled to a precision within 2°C of a desired temperature setting.

12. The compound storage and retrieval system of claim 1, wherein the racks comprise slots arranged in rows and columns.

13. The compound storage and retrieval system of claim 12, wherein the racks each comprise: 10 or more rows and 4 or more columns of slots.

14. The compound storage and retrieval system of claim 13, wherein the racks each comprise: 30 or more rows and 5 or more columns of slots.

15. The compound storage and retrieval system of claim 14, wherein the racks each comprise: 50 or more rows and 6 or more columns of slots.

16. The compound storage and retrieval system of claim 1, wherein the system comprises 40 or more slots.

17. The compound storage and retrieval system of claim 16, wherein the system comprises 100 to 300 slots.

18. The compound storage and retrieval system of claim 1, wherein the slots each comprise a unique bar code label.

19. The compound storage and retrieval system of claim 1, wherein the slots comprise one or more unique bar codes on two or more sides.

20. The compound storage and retrieval system of claim 1, wherein each slot is associated with one or more tray location indicators under control of the computer system.

21. The compound storage and retrieval system of claim 20, wherein the one or more tray location indicators comprises a light emitting diode, a light, a buzzer, a flag, or an alphanumeric indicator.

22. The compound storage and retrieval system of claim 1, wherein the slots comprise one or more lengthwise rails to slidably receive the trays.

23. The compound storage and retrieval system of claim 1, wherein the trays are adapted to receive one or more containers selected from the group consisting of: tubes, bottles, culture dishes, vials, and microtiter plates.

24. The compound storage and retrieval system of claim 23, wherein the microtiter plates comprise: 96-well plates, 384-well plates, or 1536-well plates.

25. The compound storage and retrieval system of claim 23, wherein the microtiter plates comprise one or more sample wells, and which microtiter plates comprise a seal over wells.

26. The compound storage and retrieval system of claim 23, wherein the containers each comprise a unique bar code.

27. The compound storage and retrieval system of claim 23, wherein the one or more containers comprise a plurality of compounds.

28. The compound storage and retrieval system of claim 27, wherein the plurality of compounds comprises: a chemical compound, a biochemical compound, a nucleic acid, an oligonucleotide, a peptides, a polypeptide, a protein, a carbohydrate, a cell, a serum, a phage particle, a virion, an enzyme, a cell extract, a lipid, an antibody, or a synthetically modified peptide.

29. The compound storage and retrieval system of claim 1, wherein the trays comprise 2 to 12 nests each of which are configured to hold one deep well microtiter plate, three standard microplates, or four shallow microplates.

30. The compound storage and retrieval system of claim 1, wherein the trays comprise polycarbonate.

31. The compound storage and retrieval system of claim 1, wherein the trays comprise one or more bar coded identification label.

- 32.** The compound storage and retrieval system of claim 1, wherein the trays comprise one or more handles.
- 33.** The compound storage and retrieval system of claim 1, wherein the trays comprise one or more alphanumeric label.
- 34.** The compound storage and retrieval system of claim 1, wherein the trays comprise one or more color coded labels comprising: a unique color or a color combination corresponding to a particular column or row of slots.
- 35.** The compound storage and retrieval system of claim 1, wherein the computer system comprises: one or more data input sources, one or more data storage locations, and one or more data output devices.
- 36.** The compound storage and retrieval system of claim 1, further comprising a robotic system controlled by the computer.
- 37.** The compound storage and retrieval system of claim 36, wherein the robotic system is configured to perform one or more operations selected from the group consisting of: opening the door, scanning barcodes on trays, retrieving the trays from the slots, closing the door, removing plates from the trays, scanning barcodes on plates, and sipping or pipetting a sample from plates or containers.
- 38.** The compound storage and retrieval system of claim 35, wherein the data input sources comprise a bar code reader.
- 39.** The compound storage and retrieval system of claim 35, wherein the data input sources comprise one or more operator input devices.
- 40.** The compound storage and retrieval system of claim 35, wherein the data input sources transmit data to the computer, which data comprises: one or more of a work area temperature, a storage module temperature, a work area oxygen level, or a storage module oxygen level.
- 41.** The compound storage and retrieval system of claim 35, wherein the data storage locations comprise a plate database.
- 42.** The compound storage and retrieval system of claim 41, wherein the plate database comprises data selected from the group consisting of a library name, a sub-group

description, a mother/daughter plate designation, a plate type, a plate creation date, a plate location, a compound structure for each well, and a volume for each well.

43. The compound storage and retrieval system of claim 42, the plate database further comprising a mother plate history comprising one or more of a plate activity date, a volume removed per sample and a volume remaining per sample.

44. The compound storage and retrieval system of claim 42, wherein the plate location comprises a tray location.

45. The compound storage and retrieval system of claim 35, wherein the data output devices display one or more of a work area temperature, a storage module temperature, a work area oxygen level or a storage module oxygen level.

46. The compound storage and retrieval system of claim 35, wherein the data output devices display one or more instruction for an operator.

47. The compound storage and retrieval system of claim 46, wherein the data output devices comprise a computer monitor.

48. One or more library of compounds stored in the compound storage and retrieval system of claim 1.

49. A compound storage module comprising:

(a) one or more racks; which racks comprise one or more slots arranged in rows and columns within the racks;

(b) one or more transparent lockable doors associated with the racks; which doors control access to the racks; and,

(c) a plurality of tray location indicators coupled to the racks; wherein one or more tray location indicators are associated with each slot;

wherein the storage module is a temperature controlled storage module, which temperature is -20°C to -55°C.

50. The compound storage module of claim 49, wherein the storage module comprises the racks, which racks comprise the slots, which slots receive one or more trays, which trays comprise one or more plates, which plates comprise a plurality of samples.

51. A method of controlling retrieval and storage of a plurality of compounds, the method comprising:

(a) identifying a tray location for a requested tray in a storage module, which storage module comprises a plurality of slots, which slots each receive a tray, wherein each tray has a unique identity, wherein one or more trays comprise the plurality of compounds;

(b) designating the tray location for the requested tray;

(c) directing unlocking of a door controlling access to the storage module associated with the designated tray location;

(d) confirming the identity of the requested tray on retrieval of the requested tray from the storage module; and,

(e) confirming the identity and the tray location of the requested tray upon reloading of the requested tray into the storage module, thereby controlling the retrieval and storage of the plurality of compounds from the storage module.

52. The method of compound retrieval and storage of claim **51**, further comprising repeating steps (a) to (e) for a one or more additional requested trays.

53. The method of compound retrieval and storage of claim **51**, further comprising computerized implementation of the identification in step (a), the designation in step (b), the directing in step (c), the confirmation in step (d), or the confirmation in step (e).

54. The method of compound retrieval and storage of claim **51**, wherein identification of tray location in step (a) comprises comparing an operator compound sample request with a plate database.

55. The method of compound retrieval and storage of claim **51**, wherein designation of the tray location in step (b) comprises a computer command directing actuation of one or more tray location indicators at the tray location.

56. The method of compound retrieval and storage of claim **51**, wherein said unlocking comprises actuating or de-energizing: an electromagnet or solenoid.

57. The method of compound retrieval and storage of claim **55**, wherein the actuation of the tray location indicator is cancelled when reloading of the tray is confirmed in step (e).

58. The method of compound retrieval and storage of claim **51**, wherein step (d) comprises scanning a bar code on the tray.

59. The method of compound retrieval and storage of claim **51**, wherein step (e) comprises scanning a bar code on the tray and scanning one or more bar codes at the tray location.

60. The method of compound retrieval and storage of claim **51**, further comprising a computer command directing unlocking of the door controlling access to the storage module associated with the tray location designated in step (b) only if all slots in the storage module contain a tray.

61. The method of compound retrieval and storage of claim **51**, comprising locking the door at the storage module associated with the tray location on confirmation of tray identify on retrieval and unlocking of the door after a request to reload the tray, which locking and unlocking are computer directed.

62. The method of compound retrieval and storage of claim **61**, wherein the computer command which directs unlocking of the door is suspended until a plate database is updated to reflect one or more changes to one or more plates in the tray.

63. The method of compound retrieval and storage of claim **51**, wherein a computer command directs locking of the door on confirmation of tray identity and tray location.

64. The method of compound retrieval and storage of claim **51**, wherein the trays comprise one or more plates, and further comprising updating a plate database to reflect one or more changes in the plates.

65. The method of compound retrieval and storage of claim **64**, wherein updating the plate database comprises scanning of one or more plates, which one or more plates are added or removed from the tray.

66. The method of compound retrieval and storage of claim **64**, wherein the plate database is updated by operator input of data.

67. The method of compound retrieval and storage of claim **64**, wherein the plate database is updated concurrent with the tray being retrieved from the tray location.

68. A method of controlling sample retrieval and storage, the method comprising:

(a) requesting a sample to be retrieved from a storage module, which request comprises input to a computer system, which computer system comprises a plate database of sample information, which computer system is operably linked to a storage module, which storage module comprises a plurality of samples;

(b) searching the plate database for the requested sample, thereby identifying a tray location for the sample in the storage module;

(c) directing actuation of one or more tray location indicators associated with a slot position at the tray location, thereby designating the tray location;

(d) directing unlocking of a door controlling access to the storage module associated with the designated tray location;

(e) scanning a bar code on the tray, and confirming a tray identity on retrieval of the tray;

(f) updating the plate database to reflect one or more changes in the sample information; and,

(g) scanning the bar code on the tray and scanning one or more bar codes at the tray location, and confirming the tray identity and the tray location upon reloading the tray into the storage module, thereby controlling retrieval and storage of the sample.